

NOYES (I. P.)

TORNADOES: PROPHECY OF THE WEATHER

BY

ISAAC P. NOYES.



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TORNADOES.

ISAAC P. NOYES, WASHINGTON, D. C.

By the study of details we learn principles, and only by a proper study of details can we comprehend principles. Principles, however, once grasped and understood, minute details, though still of as much importance in themselves, become a secondary matter to him who has mastered the principles that form the sum total of those details. We have the alphabet, then words, clauses, sentences, etc. The child learns the alphabet, then to form words, and finally advances to sentences and from sentences to composition in general. He who has made himself master of composition, although he heeds the correct juxtaposition of the minor details of letters and words, in one sense ignores them, or better perhaps, let them take care of themselves.

When we advance to science he who thoroughly understands the principles of his department can the better comprehend and explain all its little variations and is not all the while at a loss to explain trifling details or troubled with them as one who has not yet mastered these details.

How difficult it is to understand the situation of objects when viewed from a wrong point, and how easy to comprehend them when the right point of view is obtained. How difficult to understand the interpretations of nature through some wrong theory or false hypothesis, but how plain they become when viewed with the full knowledge of the natural laws that govern them. As for example, how difficult centuries ago to understand and to be able satisfactorily to explain the physical condition of the planets of the universe before the Copernican theory became an established fact, or to explain the properties and full purpose of the blood before the circulation of the blood was established as a fact; surely it has always been a fact, but like many other scientific facts it was for ages unknown to man. Only within the past few years, as has heretofore been stated, have we had sufficient data in the department of the weather whereby we may satisfactorily explain its ever varied changes. The daily weather map has become the instrument whereby we may understand these changes and readily comprehend the principles that govern all our weather, from the warm, quiet, sunny days that predominate in mid-summer to the cold tempestuous weather of winter and spring.

Before we had these data we were greatly in the dark on this subject as a whole. Certainly we understood certain minor details, but we were at the foot of the mountain. Through the weather map we ascend to the very highest peak and with a bird's eye view survey the whole broad landscape. We are lifted above

the earth and its commotions of whirlwind and storm, and quietly survey the scene and note its peculiarities with the combined indifference and intense interest of a commanding general surveying a battle or a surgeon performing some difficult operation. Let the elements be ever so quiet or rave so terribly, the weather map lifts us above them and we quietly note the effect and trace up the cause. And the cause of the terrible commotions that so frequently visit us are as readily traced and explained as the most balmy days of "Indian Summer."

One cause produces all the effects and all the effects proceed from one and the same cause, notwithstanding their variety, and whether wet or dry, and the various names given to them. In the past, prior to 1870, it is not surprising that from the minor and disconnected details we should have had queer notions of the weather, and that such names as typhoon, tornado, cyclone, hurricane and simoon should have been coined to represent the wind commotions of the elements in different parts of the earth, and that people should think that there must be as much difference in the things known by these various names as in the spelling and sound of the names themselves.

According to Webster, and others will not essentially differ from this authority, a

TYPHOON is "a violent whirlwind that rushes upward from the earth, whirling clouds of dust; probably so called because it was held to be the work of Typhon or Typhos, a giant struck with lightning by Jupiter and buried under Mt. $\ddot{\text{A}}\text{etna}$."

1. A violent tornado or hurricane occurring in the Chinese seas.
2. Sometimes the simoon.

TORNADO—"A violent gust of wind, or a tempest distinguished by a whirling, progressive motion, usually accompanied with thunder, lightning and torrents of rain, and commonly of short duration and small breadth; a hurricane."

CYCLONE—"A rotatory storm or whirlwind of extended circuit."

HURRICANE—"A violent storm characterized by the extreme fury of the wind and its sudden changes; in the East and West Indies often accompanied by thunder and lightning."

SIMOON—"A hot, dry wind, that blows occasionally in Arabia, Syria, and the neighboring countries, generated by the extreme heat of the parched deserts or sandy plains. Its approach is indicated by a redness in the air."

Here we have the five principal varieties of storms. At the first glance at the definitions, together with the past ideas in regard to them, it may seem absurd to some to say that they are all one and the same thing, yet nevertheless on general principles one and the same thing they are—effects from one cause and only varying in minor details as affected by local surroundings. All are caused by the rush of air toward the center of low barometer, or by the ever contending forces, heat and cold. The sun shining on some certain spot and at that point creating an intense heat, and this spot or area of heat from the motion of the earth on its axis ever moving toward the east. The intense heat following the law of physics causes the heated and rarified air to ascend and the cooler air from

around and about to rush in to fill the vacuum, or better, to prevent a vacuum, for we can never have a vacuum in open nature, as in order to secure that we must have some artificial barrier whereby the air may be prevented from entering the would-be vacuum. The vulgar phrase "just before she does she doesn't," well represents nature in her struggle to create a vacuum. With her, to attain the object that she is ever striving for is an impossibility, and through this impossibility she accomplishes other and greater physical phenomena that keep her ever fresh and impart renewed vigor to her numerous and varied subjects.

The "Typhoon" is the center of the area of low-barometer, or the center of the storm, for it is only at this place that the direction of the wind may be upward from the earth, whirling clouds of dust, the center being the point where the "whirling," if any, takes place as well as the "upward-motion." For at the center is where the winds from all points of the compass on all sides of the storm must meet. I was once in the center of an area of low-barometer in the Gulf of Mexico. The wind was from every quarter and had this whirling motion here spoken of—the upper part of the main-mast of the ship was instantly, in the twinkling of an eye—twisted from its place, where it had been so firmly held by the strong shrouds.

Could we have an ample number of stations in a country where these "Typhoons" are said to occur, we would not only see this effect at its very center, but at a great distance, from all sides, see a rush of air toward the spot where this commotion takes place. The "Typhoon" is more apt to represent the peculiar and intense features of an area of low-barometer in hot or equatorial countries. Still the cause and principles that govern it are not different from the "Tornado" which is the name universally given to severe storms that are liable to occur everywhere, and in the United States occur most frequently in our western territory, although not confined there, as such storms occasionally visit New York and New England. To fully understand the Tornado, one must bear in mind the fact that wind under the pressure of a hundred miles an hour or more, will become quite solidified and will bear along with it objects of great specific gravity. In this respect it much resembles water in great and forcible commotion, as in a storm or freshet. We well know that stone is not buoyant in water when the water is in its normal condition, yet when great storms occur along our Atlantic coasts large stones of three and four tons weight are borne from their places in sea-walls and transported quite a distance. When that dam gave away in Connecticut, some few years ago, stones of immense weight were transported upon the condensed floods for a number of miles.

When a Tornado takes place, the air rushing along a narrow way and being condensed by its great speed becomes, as it were, a thing of life and may even, and does frequently represent an immense serpent going over the ground—dirt, stones and loose materials generally, that lie along its path being swept along with the mighty current. But we are told, that the Tornado has a whirling processive and even bounding motion. This is not at all strange. Unimpeded air, or what may

be practically termed such for the time, becomes solidified in proportion to its speed—the greater the speed the more solidity. Then the greater the solidity the more it becomes a thing of life and acts like a living thing. If then in its course it meets with any stationary object it is more or less twisted and turned by that contact, which will readily account for those gyratory motions that belong to this degree of storm and are so often characteristic of it.

How account for the water that so often forms a part of it? may be asked by some. The response to this is, that being wet or dry is merely accidental. But I will pass on to the Cyclone, and take up this point again further on when I come to speak of the late Tornado (of April 18th) in Missouri.

The Cyclone as defined by Webster as being “a rotatory storm or whirlwind of extended circuit” is nothing more nor less than the center of the area of low-barometer. The size of the circle makes no particular difference—the lower the barometric pressure the more severe the storm will be, and as the winds meet at a common and moving center, from equatorial and polar regions or directions, a rotary or circular motion will be imparted to the winds at this point, and their twirling or twisting power will be in proportion to the power of *low*.

The Hurricane seems to be recognized as something peculiar to hot countries. It occurs from the same cause—concentrated heat—and the greater the heat the more powerful the generated force. That it should be accompanied with thunder and lightning is not at all remarkable; indeed it would be more remarkable if it were not thus accompanied.

Wherever there is heat and moisture there will be lightning and thunder. I place lightning first for this is the order in which it should come, the reverse order is the universal practice in using these words simply for euphony, but if we speak of them in the order in which they take place, the *lightning* must take the precedence over the *thunder*. Wherever there is sufficient heat and moisture to form clouds, lightning will be sure to follow, for it is nothing more nor less than a subtle form of heat. This will readily account for the fact that lightning is more the product of warm countries than of temperate ones, and that we in temperate climates have it, with some exceptions only in the warmer months of the year and when it occurs in the winter it is only when we have a remarkably warm spell of weather for the season. So it is not surprising that the Hurricanes of the East and West Indies should be accompanied with thunder and lightning, but rather it would be more surprising if such were not the case.

The Simoon is simply what may be termed a *dry-storm*. It occurs in dry countries where there is little water to generate clouds, and by the way, rain is purely accidental. On all satellite bodies, such as our moon, all the storms that occur there must be after the order of Simoons. If large bodies of water, in the form of lakes and streams, together with extensive woods, could be interspersed throughout Arabia and Sahara there would be no more Simoons there, but they would have just such storms as occur in countries that are well watered.

It is said that the approach of the Simoon is indicated by a redness in the air.

It is very natural that such should be the fact, for in such countries there is always an abundance of loose sand to be taken up by the wind. A friend tells me that he has seen these clouds of fine sand three hundred miles at sea, off the coast of Africa and that the steamer which he was in, was fully a day in passing through this immense mass of fine dust that had been forced by the winds out to sea.

Always when such storms as the late one in Missouri occur, far more comment is made over the mere auxiliary and accidental things than over the germane cause itself. "This storm took up trees by the roots—another demolished houses, fences, killed animals and people—another filled the air with debris—men and horses were taken up in the air—it rained frogs and toads, ashes, dirt, stones etc., etc.—The tornado moved like a huge serpent—a blackened mass—moved in a very narrow path, destroyed this house and just grazed or bounded over that one. The tornado of such a date moved along the earth, carrying everything with it. One of another date took things heavenward and terrible thunder and lightning followed in its course."

We see the same diversity in storms at sea or in great freshets, and yet storms and freshets are not much unlike each other. The same cause that produced them five thousand years ago produces them now, and will continue to produce them so long as our physical condition shall be under the laws which governed the earth at creation and that govern it now.—Though the principles are the same and universal, the details may and will vary with the localities and surroundings. And so with storms in general, whether on sea or land, and whatever lies in the path of the storm will be demolished, unless it be strong enough to resist it.

Wind moving at the rate of a hundred miles an hour will have an immense force and will not permit things, whether they be trees, toads or stones, to lie around loose. If in the way, they will be taken up on the wings of the wind and be borne along until the force of the wind so abates as to be unable longer to carry them, and if perchance it be near the center of the area of low-barometer, they may be carried upward with the ascending waves of the meeting of the currents.

In this country hardly a summer passes, but that we have from one to three or four severe storms, here generally called "Tornadoes." The term or name matters little.

The papers on the 19th of April, 1880, reported a severe storm of this kind the day previous centering mostly in the south-western part of Missouri, but quite extensive throughout the state of Missouri and parts of Kansas. One of the reports of the storm states, that everywhere along the track of the tornado was evidence of a wave of water flowing in the rear of the clouds, and that these waves or currents flowed in greatest volume up-hill, as though there was something very surprising in this fact. Water will naturally run down hill, but if there be sufficient force behind it, it may be forced up to the top of the highest elevation that the earth can produce. When a hill lies in the path of a tremendous wind-storm, it is similar to a rock or fixed object in a stream where there is an immense and rapid

current. The water will play about the obstacle if it is unable to carry it along with its force. And so with a hill in a terrific storm of wind and rain. Clouds as well as other things will be swept along with the current and where there are clouds there will be moisture, and the more clouds the more moisture, for clouds are nothing more nor less than suspended moisture, and the denser they become by the powerful squeezing process of the winds, the more apt are they to deposit that moisture and that moisture itself to be carried along as a river in the air.

Another party in discussing this tornado of the 18th of April, repeats the old idea about the cause being the meeting of two waves of air at different temperatures. Notwithstanding the firm belief in this idea, I pronounce it as ridiculous as the absurd notion that the moon affects and causes changes in the weather of our globe, and assert that a more false scientific idea never existed.—And more, I challenge proof in support of either this idea or that the moon has the least possible effect upon our weather system. What gave rise to this idea was evidently the condition of the air at the center of the area of low-barometer. Here such currents must necessarily meet, as cold and warm water might meet in a valley where one stream came from some boiling spring and the other from the melting of ice and snow on the mountain top, but the meeting of these warm and cold currents of air or water would not be the cause of any destruction that they might cause on their passage thither. The cause of the destruction would rather be owing to the rapidity with which they rushed to meet each other in this common center, on the steepness of the hill whereby the force of gravity is accelerated, or the rapid displacement of air by the power of heat at the center of the area of low-barometer.

Then there are people who somehow or other believe that "electricity" is and must some way be the cause of these severe storms, and indeed they go so far as to hold that some are *electrical* and that others are not, but are due to some other cause—but *what*, they do not know. Now the presence of electricity in these storms is purely accidental. The hotter it is the more heat will be taken up with the water that forms the clouds, so the more heat taken thus up into the air, the more electricity will there be in the air to generate the flash and light we call *lightning* and the noise we call *thunder*; which are, as I will repeat, merely auxiliary to the storm and not even essential to it, much less being the cause of it.

In all the comments in the papers thus far I have not seen the slightest allusion to the real and simple cause of this storm of the 18th of April, and the only cause of all storms of whatever nature and local peculiarities and wherever they may occur, whether at the equator or at the poles, or in Asia, Africa, Europe or America.

According to the daily weather map, published by the U. S. Signal office at Washington, at half-past seven on the morning of the 18th of April, 1880, the area of low barometer centered at about Omaha, Nebraska, nearly due north of the place where the storm of the afternoon of the 18th is noted as first starting.

Twenty-four hours later the center of the storm was at Lake Michigan, near Milwaukee, Wisconsin. According to laws heretofore referred to in these articles, the area of low barometer starts in the United States in the West, at least there is where we at present first get track of it in its passage across our continent, and as it travels east trends more or less to the north. This area of low barometer of 18th of April, 1880, traveled in a line very nearly *east-north-east*. The first starting of the storm on the afternoon of the 18th of April, is reported to have been near Fort Smith, on the Arkansas river, in the western part of Arkansas, and that it moved in a northeasterly direction. The next place of importance where it struck is reported to have been Marshfield, Missouri, while the storm, though with less force, also raged in and about Kansas City, Missouri.

Now, if one will study the map, he or she will see that the course of the storm was from the places and localities injured by the storm toward the path of the area of low barometer. Here is the simple and universal cause of all storms of this nature—a cause and effect that any one of ordinary intelligence may readily understand if he will only heed the signs. If the intelligent will not heed the signs, why, then they will be as much in the dark as the ignorant, and if anything more so. And so it is not surprising that we see published in respectable papers such ideas as that there was a similarity between the storm in Kansas and one in the Island of Sicily, in the Mediterranean, two days afterward, and that therefore both were of meteoric origin. “The Kansas dust was composed of brown and black impalpable matter, and so abundant that on the next day traces of the deposits could be seen on the surface of the ground, and on a north porch sufficient to receive the imprints of a cat’s feet” * * * The near coincidence of dates between the phenomenon in Sicily and here (Kansas), with an apparent similarity in the physical properties of the dust, might suggest a common origin.”

In the first place, I would like for the author of the above to publish to the world what a “meteoric” storm is; how it is to be distinguished from other storms; what are its peculiarities; what its general nature, and whether it is dependent upon the influence of the properties of high or low barometer, or quite independent of them. In the next place, if he knew any thing about the rapidity of storm centres, or the speed at which the areas of low barometer, which causes the storm, travels, he would have seen that it could not possibly pass over such a distance in two days, as from Kansas to Sicily, and more than this, that it is very doubtful about an area of low barometer which passes over Kansas traveling in such a direction as to pass over Sicily, or take any such like of latitude as Sicily in its course.

The area of low barometer travels with greater or less speed, probably anywhere from three hundred and fifty miles to even double this distance a day. The force or rapidity of the wind toward the center of the area of low barometer has nothing directly to do with the rapidity of the area of low barometer, but with its intensity. Relatively to the storm the area of *low* is stationary. Then as to

the direction of the winds in such storms this is purely accidental, though in America these winds are mostly toward the east. I say *toward the east* rather than *from the west*, for the reason that winds are pulled and not pushed—the force that creates them is always in advance and not behind. These storms, though generally toward the east are not always so; it depends on the location of the area of *low*. When the area of low barometer is on the land, the storm almost always follows this course, for it is natural that the greater force of the wind must be in the track of *low* as it advances toward the east from the west. For in this case we have not only the force of the wind in proportion to the intensity of this area of low barometer, but we undoubtedly have added to this the progressive force of *low* as it advances toward the east. So our tornadoes are mostly in the track of a storm toward the east—most, but not always, for some times, more especially when the area of low barometer is on a high line of latitude, the storm takes place or begins with a southeast wind. This at first may seem contradictory to previous statements, and so also may the statement that, relatively to the storm the area of *low* is stationary, but with a little study of the weather maps in connection with storms it will be seen that the wind is ever changing as the area of *low* is passing over the country. In the east first the wind will be toward the west and to the south or north of due west as the area of the advancing *low* is on a low or high line of latitude—then, after the passing of *low* more or less reversed, or toward the east. To understand this better, let any one take a sheet of paper and mark its four sides—North, East, South and West. Over the paper sprinkle some iron filings. Then, near enough to attract the iron, slowly draw a magnet from the west toward the east. It will be seen that the magnet will attract the particles of iron as it advances, and from all quarters, and that as it advances it will take up particles of iron with it, and that relatively to the iron the magnet is for the time being stationary, though the particles of iron will follow the movements of the magnet. This, so far as iron will permit, is a fair illustration of the attraction or pulling power of *low* over air, though iron being a far more inert substance than air, is not so readily or extensively affected by the magnet as the air is by the attractive force of *low*.

Then, as to the direction of the wind in a tornado, instead of being toward the northeast, or toward the northwest, it may in some localities be from the northwest, as in Washington, July 4, 1874, and yet in the track of *low*. A south west wind had been blowing all day—or in other words *toward* the northeast. Suddenly the wind changed to the northwest and blew a terrific storm that uprooted trees and unroofed houses in this locality.

In the early part of November, 1877, we had a similar storm on Long Island Sound, when the steamer Massachusetts, being caught by it on a lee shore, came near being a total wreck. In these instances the cause was the same as created the late tornado in Kansas and Missouri, only the area of low barometer was in another locality, and, therefore, the wind that caused it must be from a different quarter. It was in the track of the area of low barometer.

After all this comment on what a tornado is, the question arises, is there no preventive? There would seem not, at least at this present state and power of understanding. We may, however, ameliorate the force and concentration of the storm by the abundant planting of trees, which will have a tendency to break the force of the storm.

In conclusion, I would remark, or perhaps better repeat, that the area of low barometer is the center and generating influence of the storm—the center toward which the winds from all quarters will blow, and the force of these winds will be in proportion to the intensity or lowness of pressure at this center of *low*. This area of low barometer is ever on the move toward the east or toward the advancing sun, and its motion, at least so far as we know on land, is never reversed, although there is some probability of its changing its course on the ocean after passing off the land, as discussed in former papers. But its course on the sea, at least after passing off our coasts, is at present unknown to us. We only know that the wind is always toward *low*, and that in passing off the coast, more frequently than otherwise, the wind after just having been from the southwest, comes out from the northwest.

In order to fully explain this, we must have some stations out on the ocean; either stationary, as a light-ship, or movable, as a steam vessel might be. When this can be accomplished, we can study the direction of *low* after passing off the coast; until then we can not be certain as to its location beyond what inference we may draw as to the direction of the wind. We do know that the wind is always toward *low*, and furthermore, that tornadoes, hurricanes, or by whatever name we may call a storm, it always will be in the wake or track toward this center, or area of low barometer, wherever it may be, and that a tornado is always in order after the passing of *low*. Fortunately for us, the conditions of nature are not always favorable to it; if they were, we should have them at least once a week, and sometimes oftener.

What becomes us now is to carefully study out the course of *low* every time it passes over the country, note the conditions when a tornado occurs and when not. By careful noting of data, by and by we may be able at least to say when one will occur and when not, and as we advance in knowledge, we may, by the judicious planting of trees, or by other means not now plain to us, in a measure prevent their occurrence, or at least diminish their severity or intensity.

PROPHECY OF THE WEATHER.

BY ISAAC P. NOYES, WASHINGTON, D. C.

The weather has ever been a favorite theme for the prophets, and most miserably have they failed. All are familiar with the prophecies or statements of our almanac makers. For years they have pretended to foretell the weather for months in advance. The method by which they told, or pretended to tell, was considered a sort of "black art" that was very materially affected by the moon; and strange to say the belief in these prophets was quite universal. Few, if any, questioned their right to prophesy, and the vast majority of mankind seemed to take their sayings as true, and universally, a deal of charity was extended toward them. If the weather did not quite agree with their prophecies it mattered little. The public at large ~~are not~~ exacting, but when the weather did at all agree, even in part, with their statements, we were sure to hear it commented upon in terms indicating the utmost faith in the almanac makers. These prophets would carry the idea that their art was a matter of nice mathematical calculation and that in order to be wise in this department one must be a great mathematician. They gave no reasons—at least beyond the mysterious statement that the moon was in such and such a quarter. They were not very nice about extent and location of territory; indeed they did not even mistrust that allowance should be made for all of this.

These comments are not made with any sense of ridicule at the conditions of the past. It is not well to blame men who are bound down by the ignorance of an age that is beyond their control, or the want of knowledge in the past. We must judge men by the age and surroundings in which they live. What many good and wise men might have done in one century, the same men, if living, would not do in another. The general advancement of the world is continually throwing a new light upon things as they pass along on the great panorama of existence. We are steadily marching on. The general principles of wisdom live and increase in weight by the later interpretations. The accumulation of wisdom is throwing more and more light upon the interpretations of nature.

The old almanac makers undoubtedly thought their art a worthy one and they undoubtedly had great faith in themselves and in the various quarters and changes of the moon. We will not now quarrel with them. The advancements of these later days have made new developments in this line. When they ~~are~~ in

the dark as to facts we are in the light. With the light which the present age gives us they undoubtedly would have been as wise as we, but it was simply a physical impossibility for them to have had this modern advantage. Succeeding ages will have a similar advantage over us. For example we cannot at present accomplish many things that our minds yearn for, to say nothing of those that the human mind is not yet alive to. We cannot navigate the air. We are confined to wood and coal for universal fuel. We know little of at least one-half of the globe on which we live. We are quite ignorant of the laws of health. The imagination of man travels in advance of his intellect (so called).

The future will throw much light upon our pathway; and while now "we see through a glass darkly," as we advance, the way will become more and more plain by the accumulation of facts on various subjects, our present ignorance will be manifest, while new facts will enable us to make new combinations and to readily understand what is now unintelligible or unsatisfactory to us.

The statements of the old almanac makers, though "gospel truth" to the many, were not regarded as wisdom by the few who were more advanced in intellectual culture, yet even those of the highest culture could ~~not~~ simply say "they did not believe;" no positive evidence had yet developed by which they could successfully controvert what their intellects could not accept. They must await future developments and see what they would bring forth.

In 1870 they brought forth the United States Signal Service, whereby we were no longer confined to the accumulation of a few isolated facts gathered by men having no facilities for immediate communication with each other, or any means of conveying intelligence to one central head where it could be digested and made to serve the world as kindred facts in other departments have done.

It was not even possible for the Signal Service to grasp the full idea at once; time was needed to advance the practical work necessary for so great an undertaking, and as facts were accumulated, they suggested new fields for the intellect to revel in, until now we have a very complete system, though not perfect as yet, for time is still necessary to complete and to suggest other steps in the line of this advancing science.

The weather map has proved beyond controversy that the area of low barometer is the center and motive power of the storm, and that this area of low barometer travels, as heretofore stated, in an easterly direction, and that back of this power of low barometer, lies the generating heat force of the sun, the creator of this power. The sun is our great physical first cause in this as in other things connected with and essential to our well being on this earth.

The negative part of the weather system is the area of high barometer, which plays quite as important part in the weather of our globe as the area of low barometer itself. The details and influence of high barometer will be deferred for some future paper, simply remarking here that it is an important power and is ever on the move and in the same general direction as the area of low barometer, and that we can not have the one without the other—that the area of high baro-

eter is as essential and natural in the lighter body, air, as the hill or mountain in the physical contour of our earth.

It is not pleasant to controvert such a venerable notion as that the moon affects the weather and that by studying its various "quarters" and conditions, we may be able to prophesy the weather months in advance. The moon, it must be remembered, is continually on the move and ever progressing with the earth and the while moving around it. It therefore must necessarily, and does in turn, shine on all parts of the earth. Wherever the sun shines the moon shines also. The sun being a powerful heating body, generates the conditions we term low barometer. The moon, being a mere reflector of light, has no such power—at least its heat power is infinitesimal, and therefore has no power to produce or affect the area of low barometer. But it is often claimed that it has power over the clouds to collect or disperse them, as the case may be. On the same night with the same moon, new, first quarter, half, full, last quarter or old, the same moon is shining over territories where there is all sorts of weather, from hot to cold, and from clear, cloudless skies to extents of territory covered with the most dense snow or rain-producing clouds. In one place it may be clear, bright moonlight, in another not a ray of light to be seen even with a full moon. Then these places may be and are distributed over the earth at intervals of from 500 to 1,000 miles, and sometimes more. This being the actual condition of things, it seems most absurd to claim or believe at this day that the moon at all affects our weather, or that it may be relied upon as a basis on which to found prophecies of the weather. When the new moon is upright so that its two ends or horns are level with each other, it is claimed that throughout this moon we will have little or no rain, because the moon holds ~~the~~ water. Then when the crescent tips a little, one side being higher than the other, according to the universal idea, we will have plenty of rain during that moon. As though the rain which waters our earth, must be held in this little basin up in the sky. It must be remembered that the moon is 240,000 miles away from our earth, and at the best calculation our atmosphere is not more than forty-five miles high, and more than this that the clouds from whence comes our rain, are not over two or three miles high, and often much less, probably less even than a mile high. Our rain comes from the clouds that are temporarily suspended in the air generated through the heat force of the sun from the waters of the earth.

The sun is ever forming these clouds. The power of the moon in this particular is not worth considering even for a moment—might as well claim that the moon causes plants to grow, and is an agent for the generation and maintenance of life on this globe. As it rotates about the earth it happens that it goes through certain phases which are known as new moon, quarter, full, etc., and that at times the horns of the new moon will be level with each other and at other times not—all depending, as any one familiar with astronomy will know, on the relative positions of the sun, earth and moon. The sun will always shine on that side of the moon that faces the sun. This is a most natural effect and needs no proof. Rela-

tively to the earth the moon must change, for the simple reason that these three bodies are ever changing their relations to each other, and this readily accounts for the different appearances of what we call the "new moon," the light of the sun shining on it, relatively to us, underneath, at other times a little to one side. That these merely accidental changes of the moon that have no significance as a motive power, positive or negative, that they should be a power to affect the conditions that produce or prevent rain that comes, and can only come by the generating force or heat of the sun, is most absurd; or that it should have any power over the motion of the clouds which are concentrated or dispersed only by that power generated by the sun which we term "low barometer." The prophecy of the weather based upon any such ideas as that the moon has any influence in producing such results, is most absurd and cannot be maintained by facts or the least show of reason. We may have evenings where the sky over our particular locality becomes clouded when the moon is visible, or it may be cloudy and after awhile the clouds pass away, but not through any agency of the moon. If the moon had any such power as this, it would produce the same results every time, but we see that it does not, but rather with all sorts of moons we have all sorts of weather and changes which may readily be traced to a far more reasonable cause—that of the relative conditions of low and high barometer as effected by the great source of heat and light—the sun.

Another source of prophecy of the weather, is something which belongs rather to a season than to any extended time of years—a sort of sub-prophecy depending upon a prophecy of cold winter and warm summer, especially at the poles, is that of cold in summer developed from melting icebergs as they float down from the Arctic seas. This summer of 1880 there are a remarkable number of these icebergs. So the iceberg prophets are prophesying cold weather, especially off the Atlantic coasts.

When it becomes better understood that the heat of certain localities depends upon the concentrated power of the sun, making what we term the area of low barometer, and that this concentration is ever on the move, sometimes on a lower line of latitude the whole year through—when this beautiful law of nature is understood, it will be seen that the melting or non-melting of icebergs out in the Atlantic ocean will have no effect upon our temperature, not one tenth part as much as the melting of the ice in our ice-carts as they pass along the streets, or the melting of the ice in the refrigerators and water coolers of our houses.

Although the sun shines more directly over the equator than over the poles, and it is therefore warmer at the equator than at the poles, still the heat of the sun is not wholly concentrated there, and it is oftentimes warmer in the temperate zones than in the tropics, as discussed in a former paper, "Evidence From the Weather Map of 1879."

The melting of icebergs cools the immediate surrounding water and atmosphere, but its influence, like the melting of the ice in our ice houses, ice carts, refrigerators, or water coolers, is purely local.

In this connection the idea suggests itself that we make a better study of icebergs than we have heretofore done, and that one or more of our idle navy vessels be authorized to follow them, keeping as near them as safety will permit, and study them day by day and trace them up until the largest 'berg disappears under the heat of southern latitudes.

Another kind of weather prophet is he who pretends to foretell the kind of winter or spring we will have by certain signs that it is claimed are revealed by nature—the “old hunter and trapper out west,” and the “old man down east,” who has noted the weather for years and particularly *this year*, has observed that the wild animals of the woods have made early preparations for winter, and that the springs have filled up early, etc.

Now if any one will note these predictions they will see that they occur about every year, and that they are not reliable, and that indeed the wild animals themselves are oftentimes quite at fault. For example take the flying of wild birds south in the fall and north in the spring; so far as we are able to judge they often make a mistake. I have seen, and undoubtedly many others have also, wild geese flying south quite early in the season, and seen remarkably fine and warm weather for some weeks thereafter. I have seen robins tempted by a warm spell of weather in February when very soon thereafter it would come out cold and remain cold for a number of weeks and the birds disappear. So I do not think that the indications founded upon any such source at all reliable either as to the coming of cold or warm weather; and that the filling up of the springs comes under the same head.

Then there is another, though fortunately a smaller class, who make some pretensions to scientific wisdom who have notions that the weather of our planet must be more or less affected by the position of our earth and her sister planets in the universe. For this year, these prophets have predicted all sorts of commotions in the elements because some four of the principal planets of our system come together nearer to the sun than for some eighteen hundred years or more. Indeed they are already out with their extravagant claims that (up to July) we have already had the fulfillment of the prophecy.

Now, the weather of this year has not been remarkable for its peculiarity thus far. We have had some severe storms, but what season do we not have them? They occur more or less frequently every year. This year, thus far, (July,) has not been greatly different from the average year. But when this class of prophets have prophesied, like Jonah, they want their prophesies fulfilled even though it bring great distress upon the nations. They do not like the mortification of being false prophets, or to see their scientific pretensions laughed at by the world.

Probably the most remarkable sensation as a weather prophet at present, is Mr. Henry G. Vennor, of Montreal. The name of this gentleman has been very conspicuous in the papers the past season as a weather prophet. Many people have faith in him and verily believe that he is reliable, and are willing to swear by him and contend that he predicted this and that storm, or spell of hot or cold weather.

When men claim to be prophets we want them to come out with plain and unequivocal statements. We want no "if" or "and," or general statements of uncertain sound, but the plain statement in black and white, just what will and will not occur.

According to the *St. Louis Republican*, in a letter dated Montreal, May 18, 1880, he says: "I believe that June will be an intensely hot month, and probably the first of June will be fall-like, with frost again. July will be a terrible month for storms, with terms of intense heat, but another fall like relapse with frosts, will, in all likelihood, occur a few days before the 20th. I fear the storms of thunder and hail will be of unusual severity during July. I must claim the verification of my prediction relative to a cold wave, with frosts, over a large portion of the United States between the 10th and 15th of May. The relapse toward the close of the present month (May) will be more severe than that just past."

This is probably a fair sample of Mr. Vennor's predictions. We see that they are very general and non-committal as to exact dates and localities. When a man makes predictions of the weather we want him to specify localities as well as exact time. "Over the United States" is a very general term and covers an immense extent of territory—an oblong square of about 1,500 by 3,000 miles wherein we may have many varieties and changes of weather at the same time.

Mr. Vennor's first statement in this short article is that "June will be an intensely hot month." Where will it be hot—in Canada, or north or south of Mason and Dixon's line? It might be very hot in Pennsylvania or even in New York State, and yet very cold in Montreal. Over what territory must it be hot or cold to fulfill Mr. Vennor's predictions—in the Atlantic states, out West, or at the north or south? He claims the verification of predictions relative to a cold wave over the United States between the 10th and 15th of May.

As to the month of June, it was not unlike June weather in general, unless perhaps a little colder, as a whole. In the vicinity of Washington it was rather a cool month, though we had a few very hot days, still not as hot on a whole for the season as was the month of May. The greater part of May in this vicinity was very hot and oppressive, and that too for a very good reason—and it is never hot or cold relatively to the season, without this good reason.

May 10th and 11th it was very warm here. On the 11th, about 4:30 p. m. we (in Washington) had a summer shower with thunder and lightning, which lasted about an hour and then became cooler, as it generally does, though not always after such a storm. From the 12th to the 18th of May it was cool and pleasant, very seasonable weather for the time of the year. On the 14th of May it might have been intensely cold throughout the United States, east of the Mississippi, but for a rather unusual relative location of the area of high barometer. On the 14th of May *Low* was on a line with the south end of Florida, while *High* was to the north of Washington, thereby preventing Mr. Vennor's prediction falling true in force, or at least ameliorating it much. The latter part of May was

extremely hot notwithstanding Mr. V's. prediction that we then would have a severe relapse.

July, Mr. Vennor says will be intensely hot with terrible storms with another fall-like relapse. Now we all know that July is very apt to be hot and therefore to be accompanied with severe storms, and it not a unusual occurrence to have a cold spell or two during the summer and that we are as liable to have it in July as in June or August.

In all these statements Mr. Vennor is no nearer, and gets as far from the mark as any other man who will study the Smithsonian or other reliable reports of the weather of the United States from year to year and venture a guess in accordance therewith. Fortunately for such prophets, the people and even the people of high mental rank, are still quite ignorant of this weather question. It is a new subject. Many may disbelieve, but at the same time they are unable to refute, so are very charitable to pretensions of this kind, coming from what they think or regard as commendable authority.

To people who know nothing of the laws that govern the weather it may seem something extraordinary in a man to claim to foretell great storms weeks and months in advance, but to people who do not know these laws it appears still more extraordinary that any man of sense should attempt it; but the greater the storm predicted the more wonderful it appears in the eyes of the ignorant, if perchance one should occur anywhere near the specified time. When we know that the same laws that govern the extraordinary spells of heat, cold, rain, hail, snow, fierce winds or tornadoes as govern what we call pleasant weather we know that it would not be more difficult to tell when it will be pleasant than to tell when some fierce storm will rage.

If a man can foretell the one he can foretell the other, for all conditions of weather are governed by the same laws, but all who pretend to be prophets of this kind have always preferred to venture a guess on the extraordinary spells of weather rather than on the quiet, pleasant weather that predominates, at least in this country. Then if they can tell the weather for one day in the week, one week in the month, or one month in the year, there is no earthly reason why they should not tell all the weather of the year, from January 1st to December 31st, Sundays not excepted. For a man empirically to pretend to only foretell one kind of weather or to pick out special times to foretell is the merest nonsense. The more the laws that govern the weather are known, the more this will be evident to those able to comprehend these laws.

These changes of weather which Mr. Vennor speaks of never occur without a good and sufficient cause—a cause that may readily be understood by any intelligent person who will simply read the weather map—for it is there daily recorded in legible characters that never deceive. For example, it cannot possibly be hot in the northern part of the United States or Canada, unless there is an area of low-barometer in that locality. It cannot be cold throughout the United States unless the area of low-barometer is on a low line of latitude. There is an

endless variety of changes which the movements of low and high-barometer may make—more endless than the strains that could be played upon the “harp of a thousand strings.” Sometimes by the peculiar location of the area of low barometer it may be warmer in the extreme northeastern part of the United States, than in Virginia. For example, let the area of low barometer be located off on the Atlantic Ocean and in the immediate vicinity of Calais, Me., as it was some two or three years ago this spring. Being on a high line of latitude, it caused the warm winds from the South to concentrate there, while it being so far to the east of Washington, and reaching down into the ocean, caused a severe west wind slightly to the north of west which made Washington one of, if not the coldest (recorded) places in the United States and much colder than Calais, Me., notwithstanding the fact of lower latitude.

Now when a cause is so well known, how much better would it be for these weather prophets to say, that on such a date of such a month the area of low barometer will be in such and such a locality--then those who know what ought to follow--what would be the result of such a location of *Low*, will know just what to expect. We will know whether it is to be cold or hot, in New England and the northeast generally, or in Kansas and Missouri and the northwest. If these prophets will only tell us where *Low* will be they will far surpass their present prophecies and the world, at least the intelligent world, will truly wonder at their knowledge of the works and ways of the great mysteries of nature. But until they can do this they had better not attempt any more of their present “prophecies,” which are merely guesses which may be equaled by any number of persons who will study well the compiled weather reports of the past years and venture guesses in accordance therewith. Prophets should be men of superior and not inferior knowledge in the department in which they propose to prophesy. For such a course will only make them contemptible in the eyes of the world, when it comes to fully understand the cause that affects these matters.

In reading these comments on the prophecy of the weather, it may be asked if there is any method by which we may know or prophesy the weather for any great period in advance. For one I do not believe there is any such method, for the reason that these changes depend, as repeated over and over again in these papers, that all depends upon the location of low and high barometer and that these relations are ever changing, and the changes seem to be an endless surprise that cannot, so far as we know at present, be determined upon, even from one change to another, much less of changes that may follow each other, weeks and months in advance. Though if any law in this movement of low and high barometer is ever discovered it will only be by the careful study of the weather as recorded on the weather map.

Perhaps a regular order of movement may be discovered, but I doubt it, as the changes so far as we can see thus far are so variable, sudden and not sudden and so endless that it would seem full as easy to determine by some law where lightning will strike and where not. This being the case or the probability, it may

further be asked what is the need of a weather bureau? The reply is, two fold—to study the meteorological changes and to fortell the coming storm as far in advance as we are able. And how far in advance are we able to tell what the weather will be? may still further be asked. The practice at present is to tell one day in advance. We can however do better than this, but the time for which we can tell in advance, depends upon the meteorological conditions; sometimes it is more difficult to tell a day in advance, than at other times to tell three or four days in advance. Probably the greatest limit of time in advance is about four days, but all depends upon the regularity in which the conditions are moving. For days they will move in very regular order—a *low* starting somewhere in the west and traveling regularly toward the east; then comes a change, regular and yet irregular, when it is more difficult to foretell the weather for twenty-four hours in advance, than at other times to tell for four days in advance. The Signal office, it is claimed, some times makes a mistake—and only recently I had a reliable gentleman tell me, that a friend of his on the confidence of the morning weather report, removed the roof of his house, and a storm came up and damaged him to the amount of two hundred dollars.

This may sometimes be the case, but the Signal Office has advanced in its line of indications until they have made a record for a year of ninety-five per cent. in accuracy, and this must be acknowledged, is not far from perfection. Why not have the indications right every time? Let one become familiar with this subject and he will readily see *why*.

There are many reasons why. There are many people of exacting nature in the world, who always want positive statements that such and such *will be* or *will not be* the case, and their natures cannot conceive any circumstances but what the human mind can control; and when "circumstances" is mentioned to them, they have no place for the word in their lexicons, and with Napoleon I. when in success, they exclaim, "I make circumstances;" by and by a Waterloo comes and they see perhaps when too late, that there are circumstances which even the strongest man cannot control. If in the affairs of men there are "circumstances" beyond the control of these strong men, much more are there circumstances in nature that man must abide by. Nature is endless in her varieties, and man is powerless to prevent or at all times even to foretell her exact course. Probably nothing better illustrates this than to pour some water down a slightly inclined plane and note its course. We know that water will run down hill, but it does not take what appears to be the most direct course. We know and can readily predict that it will take, if left to itself, a certain general course, but when the practical reality takes place, we not only discover that it takes a course of its own, but that it passes over certain lines and circumvents spots, even in so small a surface as a few yards in length, that it was and would be impossible for human knowledge to specify or indicate before-hand. This being the case in nature when confined to a few yards square, what must be the effect of an area of low-barometer passing over variable territory of more than a hundred miles square.

The Signal Office can tell the course of all regular storms, but occasionally there happens an irregular change, which is analogous to this running of water down hill, as seen in the course of almost every river large or small in the world.

In conclusion, I repeat there is no other reliable process than that of the Signal Service system, whereby we may foretell the weather. All other known systems, if I may so designate or honor them, whether founded on the conditions of the moon, the habits of animals, the relation of the other planets to the planet on which we live, or the guess-work founded or unfounded on the weather of previous years—all these I hereby pronounce the merest nonsense, if not something worse, and that all these things are unworthy of any man who makes any pretense to scientific knowledge or claims any standing in advanced society.

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